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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/627,098	07/25/2003	Noriaki Kaneda	1-2-2	3673

46303 7590 01/07/2008
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EXAMINER	
LI, SHI K	

ART UNIT	PAPER NUMBER
2613	

MAIL DATE	DELIVERY MODE
01/07/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/627,098	KANEDA ET AL.	
	Examiner	Art Unit	
	Shi K. Li	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 October 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11,13-20 and 22* is/are pending in the application.

4a) Of the above claim(s) *9,10,18 and 19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,11,13-17,20 and 22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 October 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/18/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☒ Other: *Approved drawings*.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-8 and 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Phanse et al. (U.S. Patent 7,130,366 B2) in view of Walach et al. (E. Walach et al., "The Least Mean Fourth (LMF) Adaptive Algorithm and Its Family", IEEE Transaction Theory, Vol. IT-30, No. 2, March 1984) and Zerguine (A. Zerguine, "Convergence Behavior of the Normalized Least Mean Fourth Algorithm", IEEE 2000).

Regarding Claims 1-2 and 14, Phanse et al. teaches in FIG. 1 a conventional fiber optical transmission system comprising a photo-detector 16 and amplifier 18 for converting an optical signal into an electrical signal Sd. Phanse et al. teaches in FIG. 5B to process the electrical Sd with an equalizer 110b and a signal slicer 122b. Phanse et al. teaches in col. 21, lines 27-30 that the weight coefficients for the equalizer can be designed with least-mean square (LMS) method. The difference between Phanse et al. and the claimed invention is that Phanse et al. teaches LMS while the claimed invention claims least-mean 2Nth-order algorithm with N greater than one. Walach teaches a least-mean 2Nth-order (LMN) algorithm, where N is greater than one. Zerguine teaches that NLMF gives smaller error (FIG. 3) or faster convergence (FIG. 4). Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains to have modified the fiber optical transmission system of Phanse et al. to use a normalized least-mean fourth (NLMF), as taught by Walach and Zerguine, because a NLMF algorithm out-performs LMS or NLMS.

Regarding claims 3 and 15, Phanse et al. teaches in col. 20, line 48 and FIG. 8 finite impulse response filter.

Regarding claims 4-5 and 16, Phanse et al. teaches in FIG. 5C subtractor 128c for producing an error signal ef for controlling the equalizer.

Regarding claims 6 and 17, Walach et al. teaches Eq. (15)

$$W_{j+1} = W_j + 2\mu K \varepsilon_j^{2K-1} X_j .$$

Regarding claims 7-8, Phanse et al. teaches in col. 32, lines 51-56 that the invention can be constructed using either analog or digital implementations.

3. Claims 1-6 and 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Choa (U.S. Patent 6,718,087 B2) in view of Walach et al. (E. Walach et al., "The Least Mean Fourth (LMF) Adaptive Algorithm and Its Family", IEEE Transaction Theory, Vol. IT-30, No. 2, March 1984) and Zerguine (A. Zerguine, "Convergence Behavior of the Normalized Least Mean Fourth Algorithm", IEEE 2000).

Regarding claim 1, 2, and 14, Choa teaches a photo-detector for converting said optical signal to an electrical signal (see figure 6, photodetector 500; paragraph 0061) and an equalizer for removing inter-symbol interference from said electrical signal (see figure 3, adaptive equalizer 150; figure 4 weight adjustment 240; paragraph 0045) said equalizer having a plurality of coefficients configured to be updated (see figure 4 elements 220 and 250). With respect to claim 2, Choa teaches a controller to update said coefficient (see figure 4, weight updater 240; paragraph 0049). Choa fails to teach a least-mean 2Nth-order (LMN) algorithm, where N is greater than one. However, Walach teaches a least-mean 2Nth-order (LMN) algorithm, where N is greater than one. Zerguine teaches that NLMF gives smaller error (FIG. 3) or faster

convergence (FIG. 4). Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains to have modified the optical receiver of Choa to use a normalized least-mean fourth (NLMF), as taught by Walach and Zerguine, because a NLMF algorithm out-performs LMS or NLMS.

Regarding claim 3 and 15, Choa teaches said equalizer is a finite impulse response filter configured to produce a first output signal responsive to said electrical signal (see figure 4 element 150,output signal 190; paragraph 0043), said first output signal being representative of a sum of the associated electrical signal plus a weighted sum of previous ones of the electrical signal (see figure 4 element 130), wherein the previous signals are weighted by said coefficients (see figure 4 element 180).

Regarding claim 4-5 and 16, Choa teaches a slicer to produce a predicted signal for each first output signal received from the finite impulse response filter (see figure 4 decision element 140, output signal 210 and 220; paragraph 0024); a subtract0r to produce an error signal proportional to the difference between said first output signal and a corresponding predicted signal or training signal (see figure 4 adder 130); and a controller configured to update said coefficients responsive to the error signal (see figure 4 weight updater 240).

Regarding claims 6 and 17, Walach et al. teaches Eq. (15)

$$W_{j+1} = W_j + 2\mu K \varepsilon_j^{2K-1} X_j .$$

4. Claims 7-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Choa, Walach et al. and Zerguine as applied to claims 1-6 and 14-17 above, and further in view of Kaleh (U.S. Patent 5,048,058).

Choa and Walach et al. have been discussed above in regard to claims 1-6 and 14-17. The difference between Choa and Walach et al. and the claimed invention is that Choa and Walach et al. do not teach whether the equalizer is analog or digital. However, Kaleh teaches in col. 7, lines 16-26 that an equalizer can be implemented in the form of an analog equalizer or digital equalizer. Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains to have modified the modified optical receiver of Choa and Walach et al. by implementing the equalizer either as digital form or analog form based on other factors such as cost, accuracy and product market as a design choice. The Examiner recognizes that the claimed difference exist not as a result of an attempt by applicant to solve a problem but merely amounts to selection of expedients known to an artisan of ordinary skill as design choices.

5. Claims 11, 13, 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Phanse et al. (U.S. Patent 7,130,366 B2) in view of Ramaswami et al. ("Optical Network: A practical Perspective", Second Edition, by R. Ramaswami et al., Morgan Kaufmann, 2002, pp. 258-263).

Regarding claims 11 and 20, Phanse et al. teaches in FIG. 1 a conventional fiber optical transmission system comprising a photo-detector 16 and amplifier 18 for converting an optical signal into an electrical signal Sd. Phanse et al. teaches in FIG. 5B to process the electrical Sd with an equalizer 110b and a signal slicer 122b. Phanse et al. indicates automatic feedback control of the threshold with a dash line pointing to the signal slicer. The difference between Phanse et al. and the claimed invention is that Phanse et al. does not teach adjust the threshold based on signal distribution. However, it is well known in communication theory that decision

threshold should be chosen based on probability density functions of the "0" and "1" of the data stream. For example, Ramaswami et al. teaches in FIG. 4.8 that a decision threshold I_{th} should be chosen based on the signal distribution as given by Eq. (4.12), which minimizes the bit error rate. One of ordinary skill in the art would have been motivated to combine the teaching of Ramaswami et al. with the fiber optical transmission system of Phanse et al. because using such a threshold minimizes bit error rate. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust decision threshold based on signal distribution, as taught by Ramaswami et al., in the fiber optical transmission system of Phanse et al. because using such a threshold minimizes bit error rate.

Regarding claims 13 and 22, it is obvious that a varying non-stationary channel has a changing signal distribution and, therefore, the threshold should be adjusted accordingly.

Response to Arguments

6. Applicant's arguments filed 18 October 2007 have been fully considered but they are not persuasive.

The Applicant argues that Walach advises to use only LMS. The Examiner disagrees. Walach et al. clearly states on page 275, right col., "we show that for certain problems the choice of K>1 is considerably advantageous over the conventional choice K=1".

The Applicant also states, "no disclosure or suggestion could be found in the cited prior art to utilize LMF or LMN for a system with an additive Gaussian noise". However, the claimed invention does not limit itself to Gaussian noise. Furthermore, the Examiner recognizes that when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue

the known options within his or her technical grasp. KSR v. Teleflex, 82 USPQ2d 1385 (Supreme Court, 2007). In this case, the most common solutions are LMS and LMF. Therefore, it is obvious for one of ordinary skill in the art to pursue either LMS or LMF.

The Applicant argues that neither Walach nor Zerguine disclose or suggest utilizing LMF in an optical communication system. The argument is not persuasive. First, Walach or Zerguine do not exclude the use of LMF in an optical communication system. Second, Walach and Zerguine teach LMF as an alternative to LMS. Based on the teaching of Walach and Zerguine, it would have been obvious for one of ordinary skill in the art to try LMF on any systems that use LMS.

The Applicant argues that Phanse et al. and Ramaswami et al., alone or in combination, do not disclose or suggest a slicer to produce a predicted signal in response to each input signal based upon a slicing threshold, wherein said slicing threshold is varied based upon a signal distribution of said electrical signal; and a threshold control algorithm to track said signal distribution of said electrical signal and adjust said slicing threshold for a reduced bit error rate of said predicted signal, as required by claims 11 and 20. The Examiner disagrees. Phanse et al. teaches in FIG. 5B to process the electrical Sd with an equalizer 110b and a signal slicer 122b. Phanse et al. indicates automatic feedback control of the threshold with a dash line pointing to the signal slicer. The difference between Phanse et al. and the claimed invention is that Phanse et al. does not teach adjust the threshold based on signal distribution. However, it is well known in communication theory that decision threshold should be chosen based on probability density functions of the "0" and "1" of the data stream. For example, Ramaswami et al. teaches in FIG. 4.8 that a decision threshold I_{th} should be chosen based on the signal distribution as given by Eq.

(4.12), which minimizes the bit error rate. One of ordinary skill in the art would have been motivated to combine the teaching of Ramaswami et al. with the fiber optical transmission system of Phanse et al. because using such a threshold minimizes bit error rate. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust decision threshold based on signal distribution, as taught by Ramaswami et al., in the fiber optical transmission system of Phanse et al. because using such a threshold minimizes bit error rate.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shi K. Li whose telephone number is 571 272-3031. The examiner can normally be reached on Monday-Friday (7:30 a.m. - 4:30 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571 272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

skl
3 January 2008

Shi K. Li
Primary Patent Examiner

FIG. 1
PRIOR ART

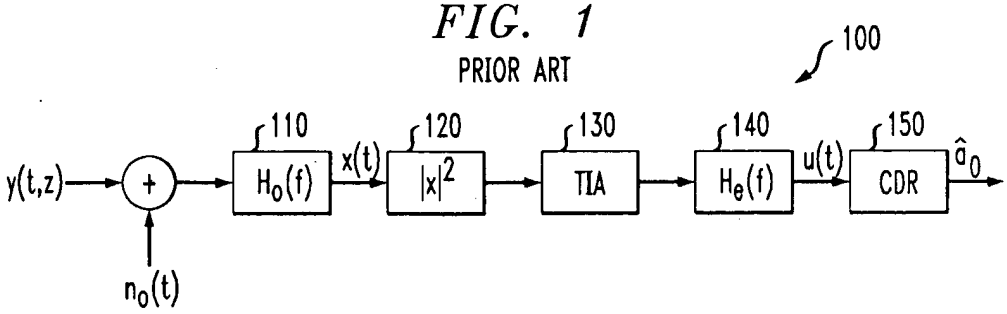


FIG. 2
PRIOR ART

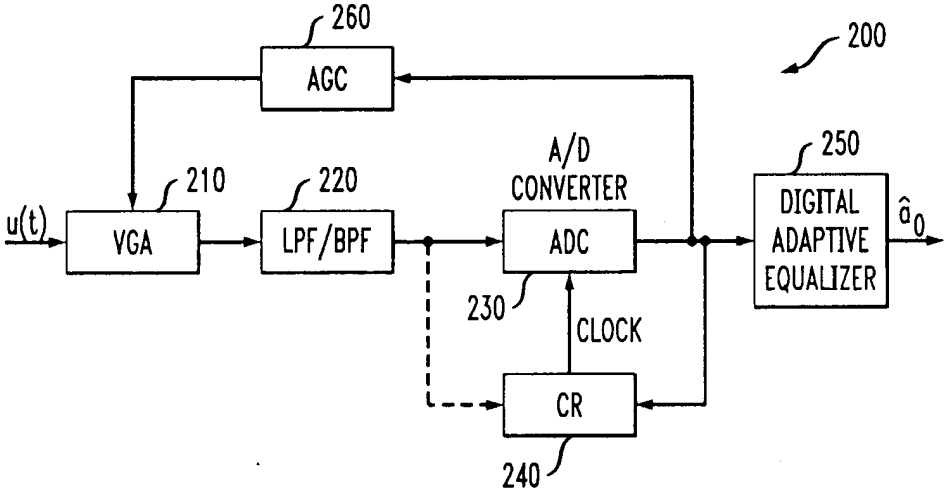


FIG. 3
PRIOR ART

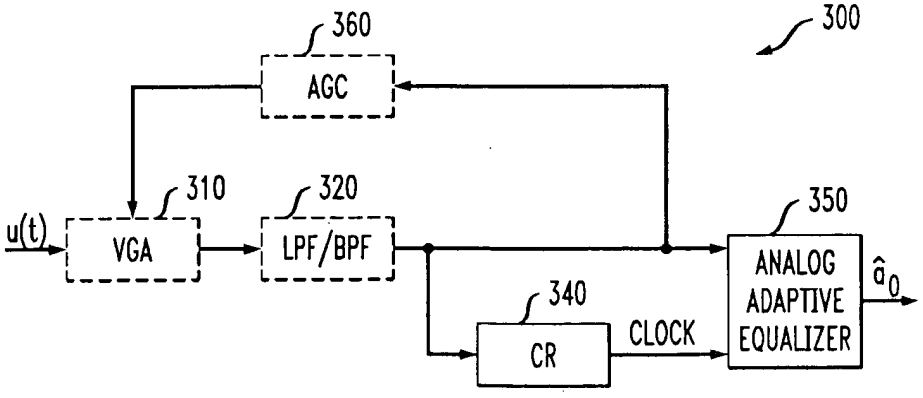


FIG. 4

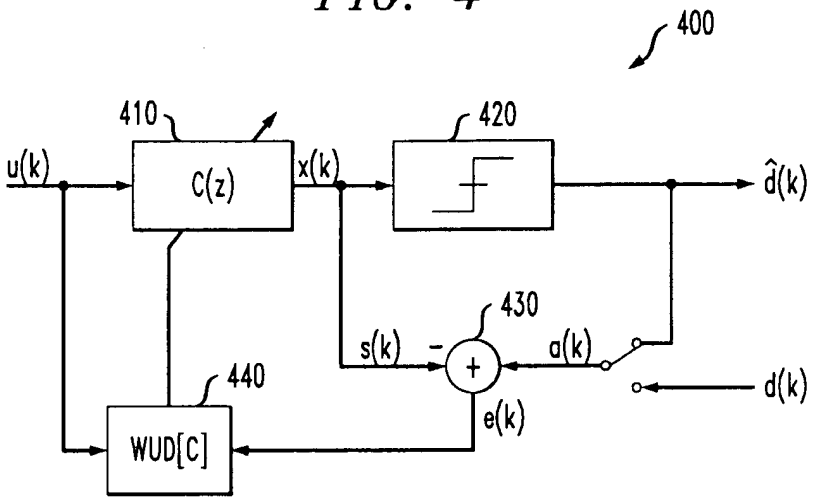
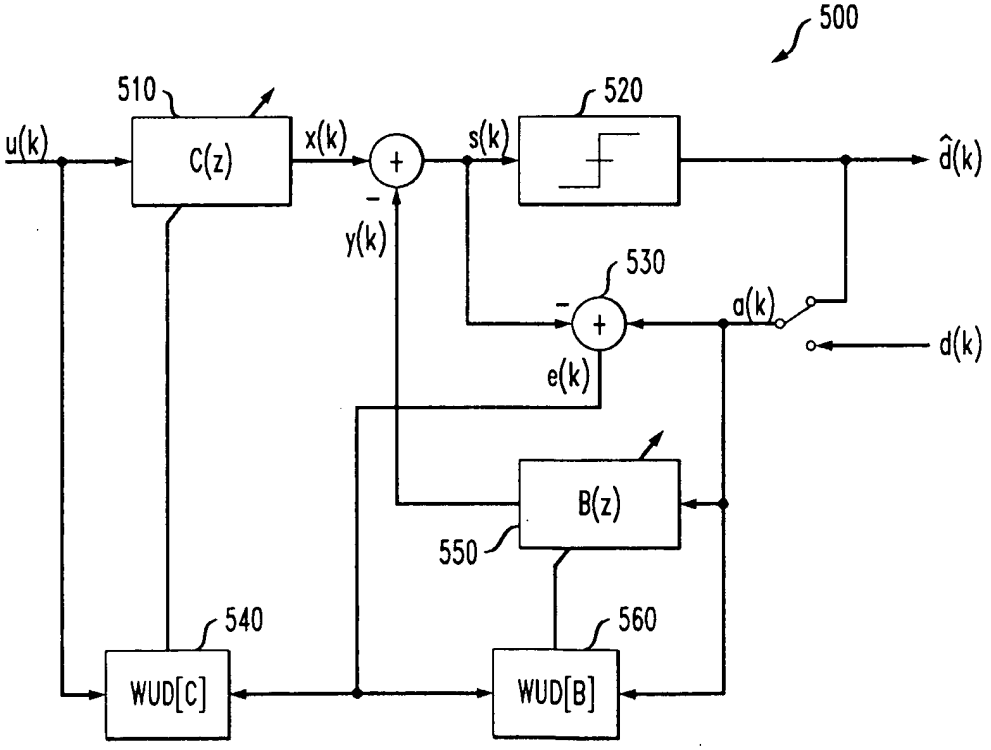

400
410
420
u(k)
C(z)
x(k)
$\hat{d}(k)$
430
s(k)
a(k)
d(k)
440
e(k)
WUD[C]

FIG. 5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510
520
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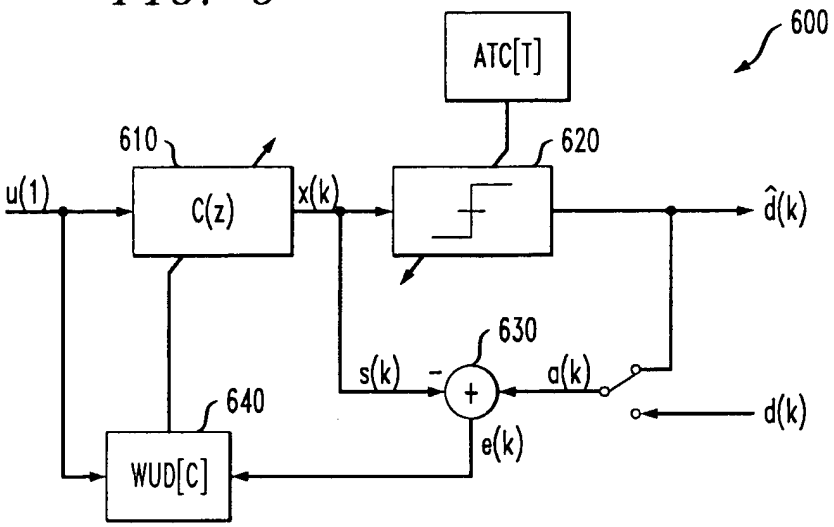
C(z)
x(k)
s(k)
$\hat{d}(k)$
y(k)
530
a(k)
d(k)
e(k)
B(z)
550
540
560
WUD[C]
WUD[B]

FIG. 6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ATC[T]
610
620
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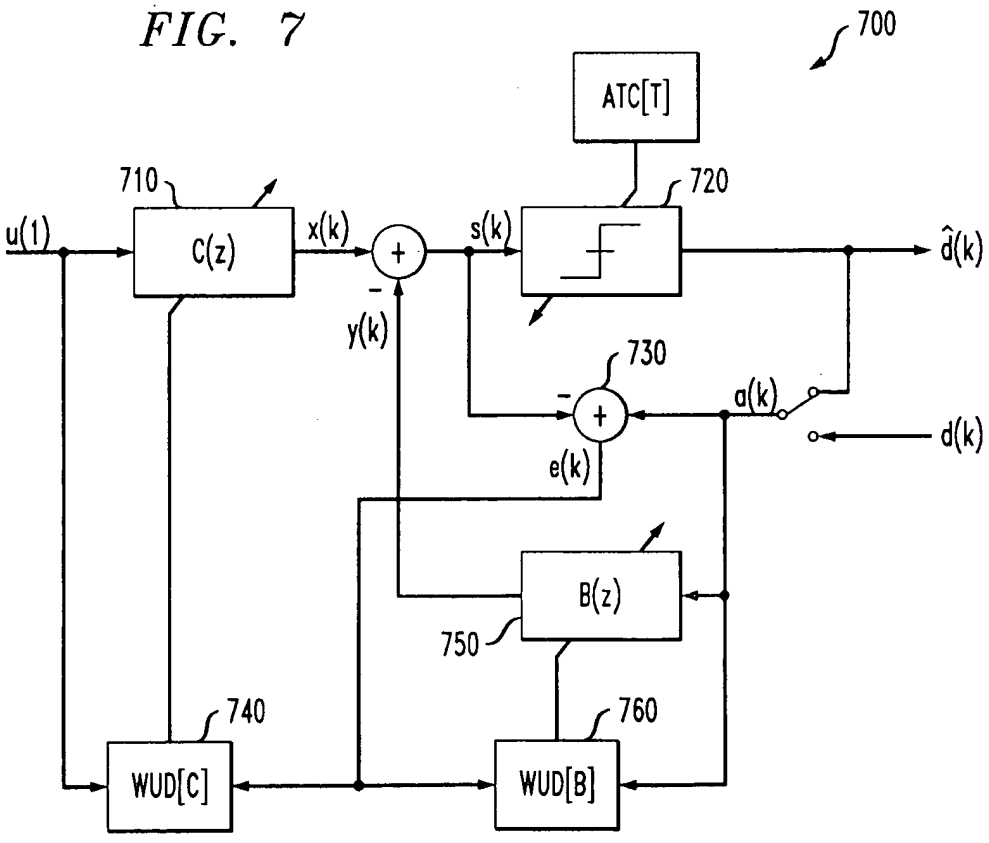
C(z)
x(k)
$\hat{d}(k)$
630
s(k)
a(k)
d(k)
640
e(k)
WUD[C]

FIG. 7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710
720
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C(z)
x(k)
s(k)
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d(k)
e(k)
B(z)
750
740
760
WUD[C]
WUD[B]